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Measuring the Economic Footprint of the Biotechnology Industry in the European Union

Prepared for EuropaBio – The European Association for Bioindustries

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Executive summary

This economic impact study was conducted by WifOR Institute – an independent research institute specializing in impact analysis – on behalf of the European Association of Bioindustries, EuropaBio.

It estimates the contribution of the biotechnology industry to the EU economy and labour market in terms of gross value added, employment and trade. This study examines the economic impact of the biotechnology industry across the 27 European Union member states from 2008 to 2022.

Direct, indirect, and induced effects generated by the biotechnology industry in the EU are quantified in accordance with the system of national accounts and using a multiregional input-output model.

TRADE AND EXPORTS

Biotechnology outputs deliver a significant trade surplus for the EU with its global trading partners, at a value of €51.7 billion in 2022, a sevenfold increase since 2008. The economic value of healthcare biotechnology exports rose significantly in 2021 and 2022 (up 35% since 2020), indicative of the European Union's role in COVID-19 pandemic response, whilst exports across all biotechnology sectors have grown consistently each year since 2008.

GROSS VALUE ADDED

Gross value added (GVA) from biotechnology activities hit €38.1 billion in 2022, almost doubled since 2008. Whilst healthcare biotechnology remains the dominant contributor, reflecting the maturity of the sector, industrial biotechnology is the fastest growing subsector in terms of GVA, with a growth rate of 5.3% – more than twice that of the EU total economy.

EMPLOYMENT

Employment growth through biotechnology is six times higher than the overall EU economy, with industrial biotechnology developing the fastest – growing over 7.5 times the EU average, with a steep increase over the years 2019 – 2022. The spillover effect is also significant, as each job in industrial biotechnology generates 3.4 additional jobs in the broader economy.

PRODUCTIVITY

Biotechnology is one of the most economically productive industries. Across all sectors, it generates €160,000 GVA per person employed, with healthcare biotechnology leading the way at €177,600. This is 2.85 times higher than the EU economy's average and exceeds sectors such as finance, ICT and automotive.

The purpose of this study is to estimate the economic impact of the production activities of EU enterprises applying biotechnology in their manufacturing and research processes. This is achieved by analysing economic data related to the production and trade biotechnology- associated products. Despite this, the study does not, by definition, capture the substantial economic activity linked to those companies that may be pre-revenue or providing biotechnology services.

This exclusion is particularly relevant for the EU's large population of start-up and scale up companies, which can remain pre-revenue for extended periods, particularly in sectors such as health, where a novel therapeutic may take over ten years to reach patients as a reimbursed product (and indeed may be finally delivered by a different company). It does capture the value many of the products that are consumed by this community during its growth, however it reinforces the fact that the EU biotechnology sector is a significant economic engine within the EU and that the innovator foundation of Small and medium-sized enterprises (SMEs) drives economic value delivered later in the value chain.

The analysis covers the years between 2008 and 2022, focusing on contributions to economic growth and employment. Estimations of direct as well as indirect and induced effects (so-called spillover effects) are considered, in total tagged as "footprint". The impact is analysed regarding to employment and contribution to gross domestic product (GDP), the latter being measured in terms of gross value added (GVA). Therefore, this economic footprint analysis provides an overall economic picture of the EU biotechnology industry supplemented by trade and intramural R&D figures. It sheds light on the performance of the industry, its direct contribution to Europe's GDP and labour market, as well as on the spillover effects occurring in European supply chains.

The regional scope of the study covers the 27 EU member states. However, as official statistics do not record any production of biotechnology goods in Cyprus, Luxembourg, and Malta, this context should be taken into account when interpreting the results. A detailed description of data sources and methodology is available in the methodology chapter.

The results show that the biotechnology industry contributed €38.1 bn GVA to the growth of the EU economy in 2022. If indirect and induced effects are considered, this amount increases to €75.1 bn. This simply means that every Euro of GVA directly generated by the biotechnology industry supports additionally €0.97 GVA in the EU economy. In most categories considered within this report, biotechnology substantially exceeds the EU average pace of growth, in many instances by multiple factors. This outperformance underscores the sector's considerable economic contribution to the EU. Between 2008 and 2022, the biotechnology sector achieved an average annual employment growth rate of 2.7%, significantly surpassing the total economy's 0.4%. Likewise, gross value added (GVA) in biotechnology increased at an average annual rate of 4.7%, compared to 2.6% for the overall economy. During the same period, biotechnology exports grew at an average annual rate of 10.6%, far exceeding the 4.3% growth rate of total exports, highlighting the sector's increasing global integration.

This study was commissioned by EuropaBio, the European Association of Bioindustries, with the objective to better quantify the impact of the biotechnology industry on the European Union's economy.

1 Biotechnology: definition

1.1 Definition of biotechnology and differentiation to related sectors

This study refers basically to the definition of the Organisation for Economic Co-operation and Development (OECD), which is a generally accepted definition of biotechnology (see Figure 1 for more detail).

Figure 1: OECD definition of biotechnology

In 2002, the OECD developed both a **single definition** of biotechnology and a **list-based definition** of different types of biotechnology techniques.

"The application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services."

This single definition covers all modern biotechnology but also many traditional or borderline activities. Thus, the OECD recommends that the single definition should always be specified by the list-based definition.

DNA/RNA	Genomics, pharmacogenomics, gene probes, genetic engineering, DNA/RNA sequencing/ synthesis/amplification, gene expression profiling, and use of antisense technology, large-scale DNA synthesis, genome- and gene-editing, gene drive.
Proteins & other molecules	Sequencing/synthesis/engineering of proteins and peptides (including large molecule hormones); improved delivery methods for large molecule drugs; proteomics, protein isolation and purification, signaling, identification of cell receptors.
Cell & tissue culture & engineering	Cell/tissue culture, tissue engineering (including tissue scaffolds and biomedical engineering), cellular fusion, vaccine/immune stimulants, embryo manipulation.
Process biotechnology techniques	Fermentation using bioreactors, bioprocessing, bioleaching, biopulping, biobleaching, biodesulphurisation, bioremediation, biofiltration and phytoremediation.
Gene & RNA vectors	Gene therapy, viral vectors.
Bioinformatics	Construction of databases on genomes, protein sequences; modelling complex biological processes, including systems biology.
Nanobiotechnology	Applies the tools and processes of nano/microfabrication to build devices for studying biosystems and applications in drug delivery, diagnostics etc.

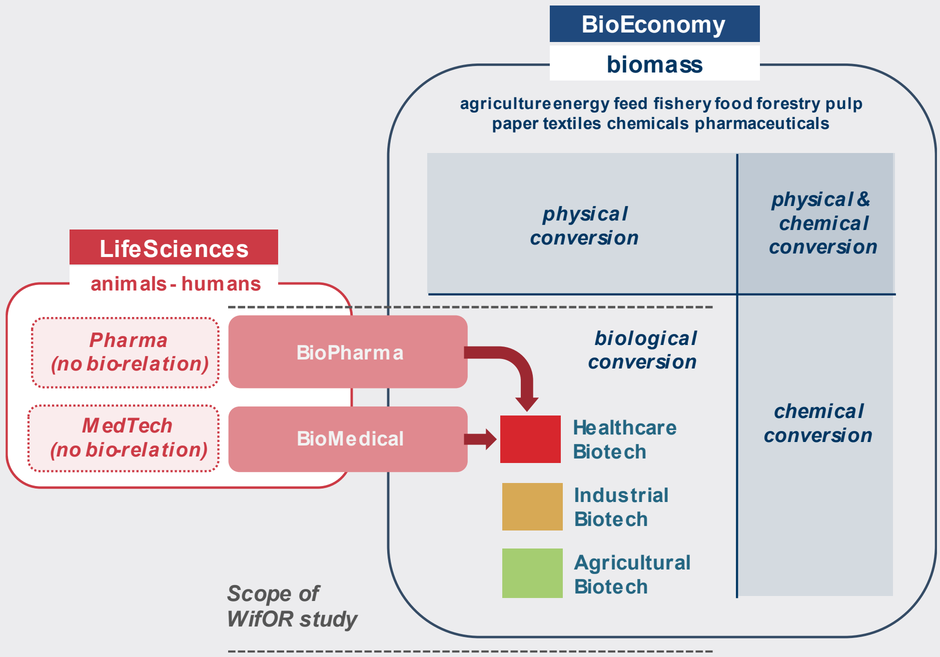
Source: OECD, 'Revised Proposal for the Revision of the Statistical Definitions of Biotechnology and Nanotechnology'.

Thus, biotechnology is "the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services."

Often biotechnology is linked to *Life Sciences*. There is no precise and commonly applied definition of Life Sciences, but the term is habitually used to encompass all activities from the biotechnology, medical device and pharmaceutical sector with regard to human or animal health. Thus, besides biotechnology, other technologies are used, such as physical (medtech) and chemical (pharma) technologies.

In addition, the term *Bioeconomy* is often linked to biotechnology. In 2012, the European Commission (EC) published its Bioeconomy strategy "Innovating for Sustainable Growth: A Bioeconomy for Europe"[1], which was subsequently updated in 2018.[2] The EC definition is as follows: "The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services." Whilst *Bioeconomy* at EU level does not include healthcare applications, other major regions, such as the US, plus some EU member states do include healthcare, with *Bioeconomy* reflecting all sectors.

Figure 2: Context of the sectors life sciences, biotechnology and bioeconomy



Own illustration.

Biotechnology is a subset of bioeconomy where biological resources (biomass) could be processed or treated by biological (biotechnology), chemical, or physical means (technologies). This and the context of biotechnology within Life Sciences is

[1] European Commission, 'Innovating for Sustainable Growth. A Bioeconomy for Europe'.
[2] European Commission, 'A Sustainable Bioeconomy for Europe. Strengthening the Connection between Economy, Society and the Environment: Updated Bioeconomy Strategy'.

schematically illustrated in Figure 2. In the initial predecessor study[3], this industry definition was applied for the first time. In the present update, the same industry definition is applied again without any changes, ensuring comparability.

As previously mentioned, this study focuses on biotechnology, which is distinct from the broader bioeconomy (including physical and chemical conversion of biomass), conventional pharmaceutical technologies, and medtech. Within the biotechnology sector, a further distinction is made between healthcare, industrial, and agricultural biotechnology, as shown in Figure 2.

1.2 Impact and value of biotechnology

Biotechnology has the unique advantage to be applicable to a variety of processes in many sectors like healthcare, industrial and agriculture. Gene technology, including gene editing techniques like Crispr-Cas9 can be applied across different fields and have a transformative effect in their areas of application. Very few other sectors enhance health, quality of life, knowledge, industrial process innovation, productivity, and environmental protection as biotechnology does.

From new drugs that can address unmet medical needs, fight epidemics and change paradigms in rare diseases, biomanufacturing industrial processes that use biological and renewable feedstocks instead of fossil-derived sources, through to adapted agri-food innovation that allow farmers and food producers to better feed more people under increasingly restrictive climatic conditions, the applications of biotechnology are highly diverse. It promises to address key challenges for societies, including pandemic preparedness, health and well-being, global warming and destruction of biodiversity. Promoting and investing in biotechnology will have positive economic, societal and environmental impact.

Until now, the most significant economic footprint of biotechnology has been measured in the healthcare sector, reflecting the sector maturity and more clearly defined outcomes. Industrial biotechnology applications, however, are now demonstrating rapid growth in economic indicators, as they become integral to many more sectoral applications.

[3] Haaf, Hofmann, and Schüler, 'Measuring the Economic Footprint of the Biotechnology Industry in Europe'.

2 European biotechnology industry’s economic footprint

The aim of this study is to analyse the biotechnology industry within a macroeconomic framework. Unlike a purely business-oriented perspective, this approach evaluates the industry's integration into value chains and its broader significance to the overall economy. By adopting this methodology, the findings can be aligned with national accounts data from statistical offices, providing stakeholders and the general public with more precise and actionable insights.

In essence, the focus shifts from examining companies and their individual metrics to analysing the goods they produce. This approach encompasses the output of all enterprises regardless of their size, enabling a comprehensive assessment of the biotechnology sector's impact on the European economy as a whole.

Economic value is typically measured using gross domestic product (GDP), which represents the total market value of all finished goods and services produced within a country's borders during a specific time period. A related measure is gross value added (GVA), which is derived by adding subsidies and subtracting taxes on products from GDP.

In this analysis the focus will be on the following key indicators:

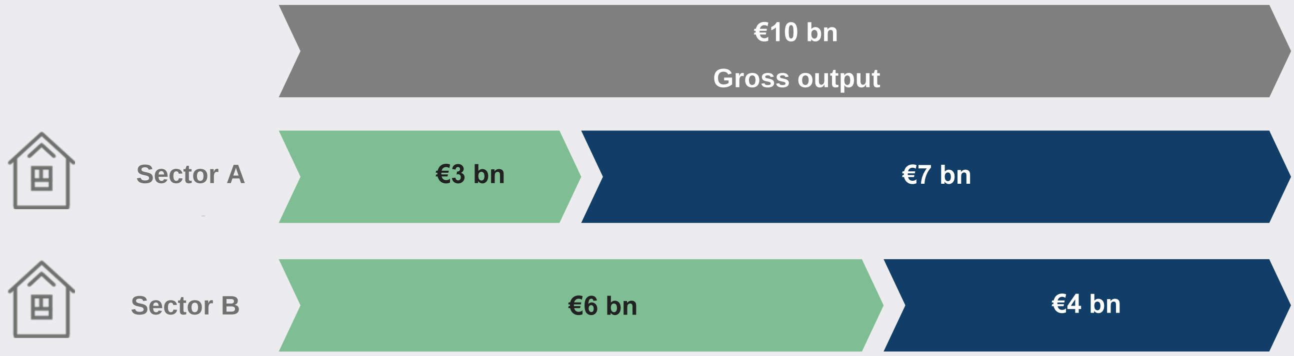
- **Gross value added:** Biotechnology’s contribution to GDP
- **Employment:** The number of jobs created, measured on a headcount basis
- **Trade:** The aggregated value of exported or imported biotechnological produced goods from or into the EU
- **Impact of R&D:** Direct GVA of intramural R&D activities in the considered industries
- **Labour productivity:** Direct GVA per employed person

While the initial study was commissioned during the Brexit period and calculated values for the EU including the United Kingdom (EU28), the present study exclusively reflects results based on the current scope of the European Union (**EU27**, as of March 2025).

2.1 Gross value added as a key figure to measure the contribution to the economy

A central figure of the economic impact analysis is gross value added (GVA). It is used to assess the economic contribution of companies or industry sectors to a national or regional GDP. In this sense, GVA is the equivalent of GDP on company or industry level. Figure 3 illustrates why GVA is better suited to measure economic contributions than, e.g., revenue.

Figure 3: Output and gross value added



Own illustration.

The illustration shows two industry sectors generating the same amount of gross output while their GVAs differ. This difference lies in intermediate consumption: Direct GVA is defined as the difference between output and intermediate consumption such that sector A has a higher GVA and hence its direct GDP contribution is higher than sector B's. Sector B's higher intermediate consumption on the other hand may trigger larger indirect GVA contributions along its supply chains. These may, however, occur outside the economy under consideration. In this way, GVA draws a more detailed and complete picture of the macroeconomic performance of an economic agent than revenue alone.

Due to its strong link to the GDP, the GVA enables companies and industries to report their performance in a way that ensures comparability with other economic actors as well as political targets. Many political goals are defined in terms of GDP or value added, such as the Europe 2020 target to spend 3% of GDP on research and development.[4]

Key findings from the economic impact on the EU economy of the European biotechnology industry are presented in the following pages. The aggregated economic

[4] Council of the European Union, 'Budapest Declaration on the New European Competitiveness Deal'; European Commission, 'Taking Stock of the Europe 2020 Strategy for Smart, Sustainable and Inclusive Growth'.

contributions of the biotechnology industry to the EU economy are presented in terms of gross value added, employment and trade.[5].

Gross value added effects

Biotechnology as we define it, is a cross-sectoral industry. Apart from that, the three subsectors (healthcare, industrial and agricultural biotechnology) mostly reflect the characteristics of their corresponding industry sectors (pharmaceutical and chemical manufacturing, agriculture) in terms of for example labour productivity or intermediate consumption. For the purpose of this study, selected goods[6] from the food sectors are included to comply with the industry definition given in the methodology chapter. This also reflects the increasing application of biotechnology within food production. As it is a selection, their scale of impact on the total biotechnology sector is marginal as they are included to illustrate growth and trends within a biotech-specific context.

Figure 4: Total contribution to GDP

Direct, indirect, and induced GVA effects of Europe's biotechnology industry in 2022.
Source: Eurostat: Prodcom database; WifOR analysis.

In terms of direct GVA, the biotechnology industry's contribution of €38.11 bn accounts for about 1.58% of the European industrial sector. In other words, this is approximately one third of the size of the computer manufacturing sector.[7] The highest direct GVA is created by pharmaceutical biotechnology (€32.75 bn), followed by industrial biotechnology (€5.18 bn) and agricultural biotechnology (€0.18 bn).

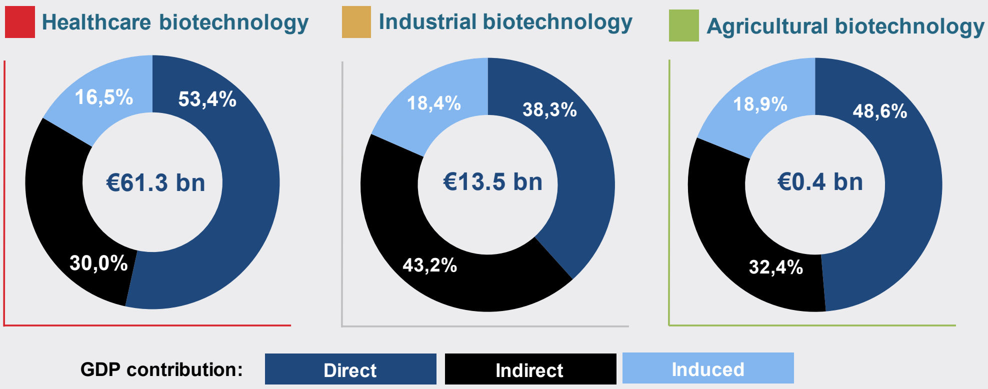
The total GVA effects amount to €75.16 bn, which is roughly half the GDP contribution of the European R&D sector.[8] Of these €75.16 bn, direct effects account for 50.7%.

[5] Comparisons to European industries are based on official data for the EU aggregate.
[6] Included products from the food and feed sector are: yeast, human milk oligosaccharides, food colorants and several preparations for animal feed.
[7] Manufacture of computer, electronic and optical products (NACE C26): €113.7 bn in 2022. Eurostat: NAMA 64a: National accounts aggregates by industry.
[8] €145 bn in 2022, EU, NACE M72: Scientific research and development. Eurostat: NAMA 64a: National accounts aggregates by industry.

The remaining 49.3% or €37.05 bn are spillover effects triggered throughout the overall economy in the EU. These spillover effects consist of €24.36 bn in indirect and €12.69 bn in induced effects (see Figure 4). Correspondingly, for each directly generated Euro of GVA, an additional of €0.97 were generated in the EU economy.[9]

Broken down by the biotechnology subsectors, the characteristics of these industries can be easily identified. The GVA spillover effects (indirect and induced combined) of the industrial biotechnology are significantly higher than in the pharmaceutical or agricultural subsector as they rely more heavily on intermediate inputs. Similarly, it follows that due to the high level of specialization and a somewhat more isolated integration into the overall economy, the spillover effects in healthcare biotechnology are the smallest (Figure 5). This is equivalent to saying that the majority of value creation occurs during production, rather than in upstream sectors.

Figure 5: Total contribution to GDP, effect distribution per sector

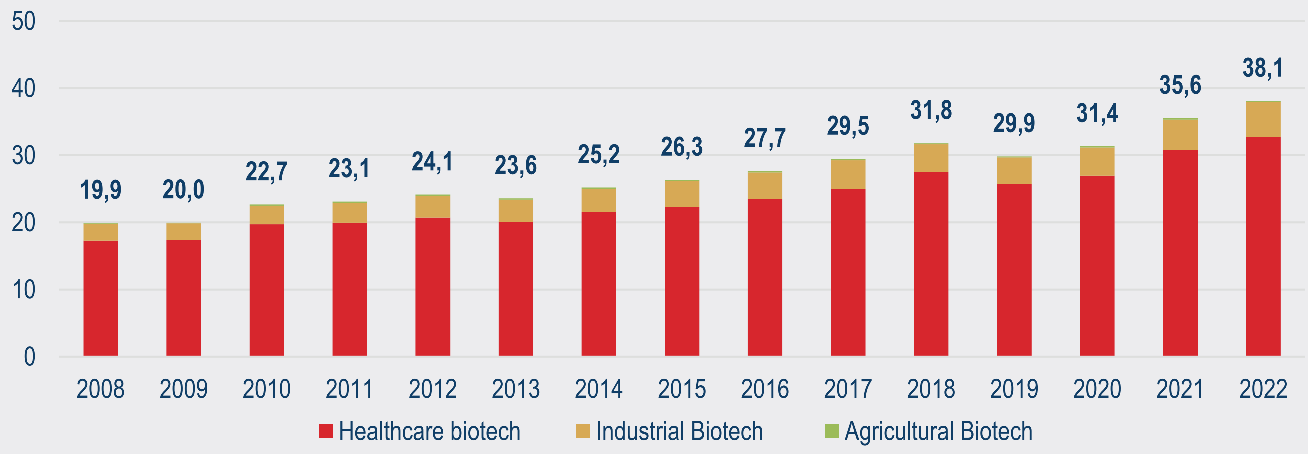


Distribution of direct, indirect and induced GVA effects for the biotechnology sub-sectors.
Source: Eurostat: Prodcom database; WifOR analysis.

A longer-term view shows that the contribution to growth made by the EU biotechnology industry has grown steadily since 2008, except for the years of 2013 and 2019. The biotechnology sector is thus a relevant growth driver (Figure 6). One reason for this is the expanding adaptation of biotechnological processes, which are increasingly replacing and displacing conventional production methods.

[9] The spillover multiplier is the ratio of spillover effects to direct effects.

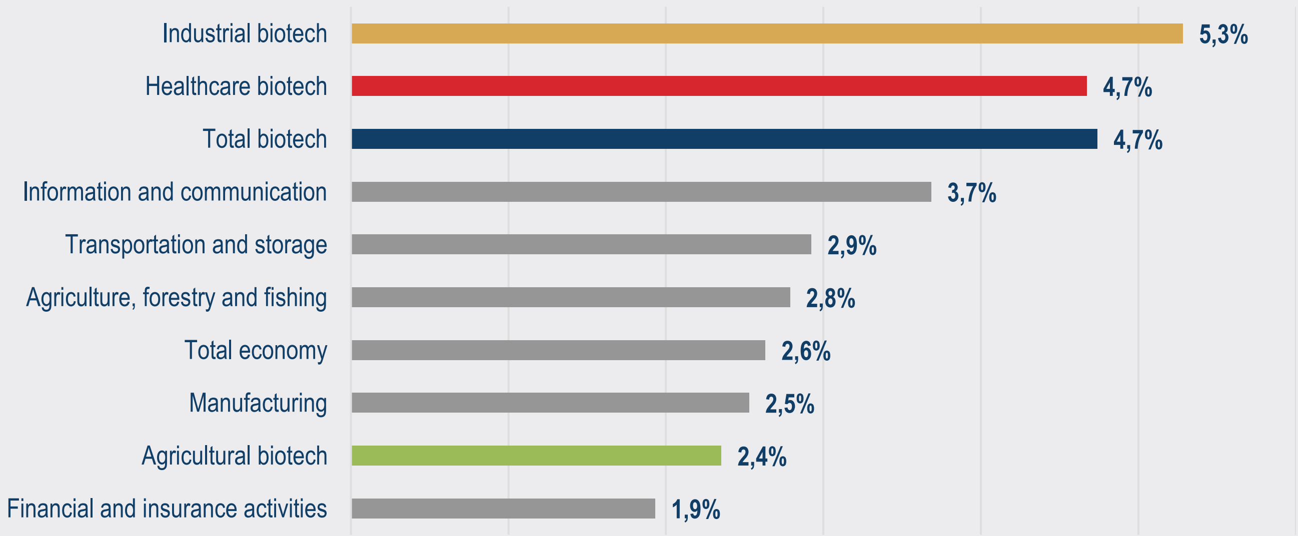
Figure 6: Direct GVA effect caused by Biotech sectors



GVA time series for the EU biotechnology industry (EU, current prices). Source: Eurostat: Prodcom database; WifOR analysis.

The average growth rates support this interpretation, as each of the three biotechnology sectors has a higher growth rate than the total economy (Figure 7). In addition, the biotechnology sector can also exceed the growth of other highly innovative industries such as Information and Communication (3.7%) in the time frame 2008 to 2022. Out of the three biotechnology sectors the healthcare biotechnology sector shows the highest absolute contribution to the GDP (€32.75 bn), while the highest growth rate is held by the industrial biotech sector (5.3%).

Figure 7: GVA growth rates

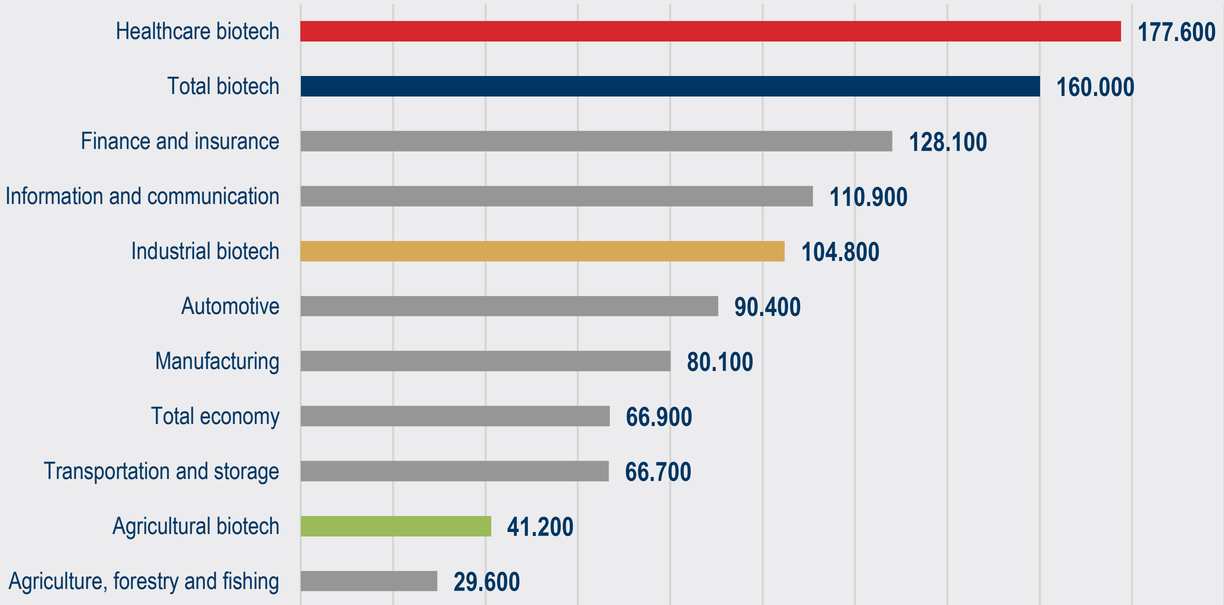


GVA compound average growth rate, (2008-2022).
Source: Eurostat: Prodcom database, NAMA 64a; WifOR analysis.

2.2 Labour productivity

The labour productivity of the EU biotechnology industry amounted to €160,000 GVA per employed person (Figure 8). This comparably high labour productivity shows that the EU biotechnology industry is very efficient and capital intensive.

Figure 8: Labour productivity



Labour productivity in the EU, 2022, GVA in Euro per person employed.
Source: Eurostat: Prodcom database, NAMA 64a, NAMA 64e; WifOR analysis.

The biotechnology industry outperforms even highly productive industries such as information and telecommunication (€110,900) or financial and insurance activities (€128,100) and positions itself well above the manufacturing industry (€80,100), and the total economy (€66,700).[10]

2.3 Employment effects

In addition to their GDP contribution, the EU biotechnology industries also contribute to the EU labour market as can be seen in Figure 9. In 2022, around 913,160 people were directly employed in the EU biotechnology industry, most of them in the healthcare biotechnology sector (184,400; 77.4%), followed by industrial biotechnology (49,400; 20.8%) and agricultural biotechnology (4,400; 1.8%). Yet, those employment figures only partly reflect the biotechnology sector's total workforce, as they exclude many early-stage companies and service providers that remain pre-revenue for extended

[10] Latest industry data for EU aggregates from Eurostat.

periods. This highlights the sector's reliance on highly skilled labour and its broader economic significance beyond directly measurable employment.

Figure 9: Total contribution to the EU labour market

Direct, indirect, and induced employment effects of the EU biotechnology industry.
Source: Eurostat: Prodcom database; WifOR own table; WifOR analysis.

In addition to these 238,000 jobs directly created by the biotechnology industry, they also supported almost 674,990 indirect and induced jobs. Consequently, the total employment effects of the EU biotechnology industry amount to 913,160 jobs. The reason for the additional 674,990 jobs on top of the jobs directly created is that the biotechnology industry purchases services and goods from suppliers, which in turn leads to an increase in production and employment in the supplying industries (indirect jobs). Moreover, generated income along this value chain is spent in the overall economy and thus triggers additional job creation.

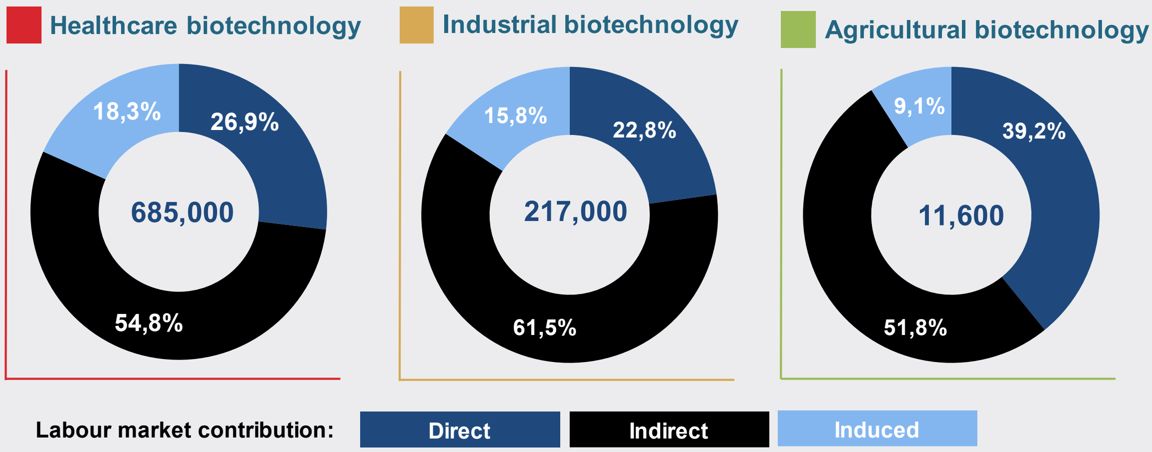
This effect varies depending on the industry and its corresponding supply chain. For the biotechnology industry, this translates into an employment spillover multiplier of 2.8, or in other words, for each direct job in the biotech sector, another 2.8 jobs were supported within the overall economy. As industrial biotechnology expands across sectors, its spillover effect may evolve, particularly if increasing specialization in supplier industries and deeper cross-sectoral integration leads to a higher employment multiplier.

This value is in the upper middle range: For example, the spillover multiplier of the automotive industry is ahead with 3.3, meaning that for one job approximately more than three additional jobs are supported along European supply chains. But there are also sectors with a substantially lower employment multiplier, for example in the wholesale trade sector 2.3 and in the agricultural sector only 1.6 additional jobs are supported along the value chain.[11] The differences in the multiplier for the chemical

[11] Latest industry data for EU aggregates from WifOR own.table 1.0.

sector (3.6) and industrial biotechnology (3.4) - which is largely defined by chemical goods - reflect the differing weightings of EU member states in the overall industry compared to industrial biotechnology specifically.

Figure 10: Total contribution to EU labour market, effect distribution per sector

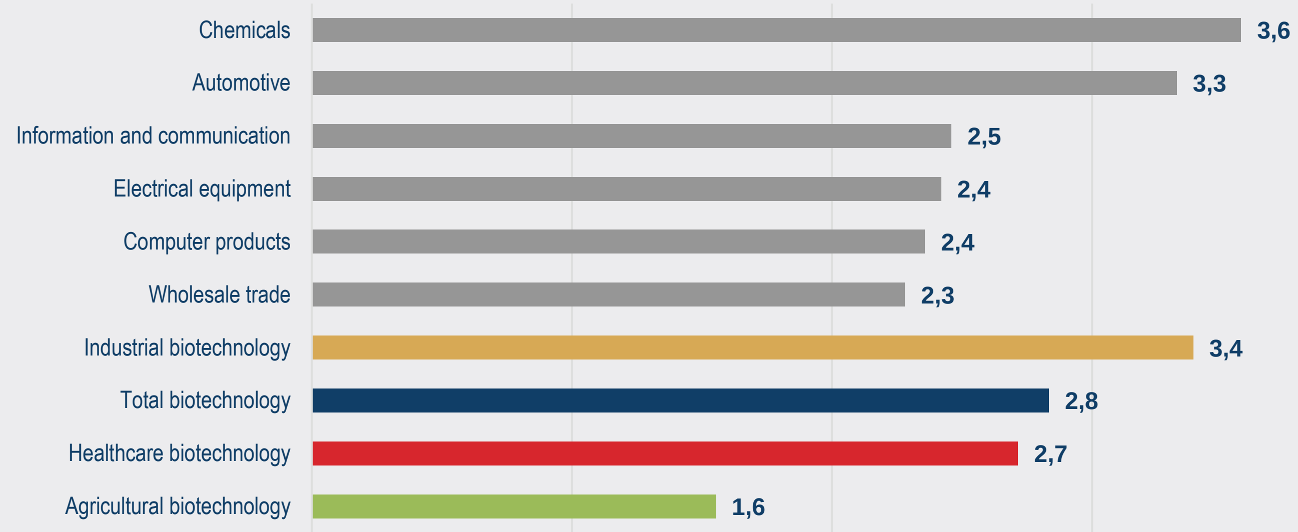


Distribution of direct, indirect and induced employment effects for the biotechnology sub-sectors.
Source: Eurostat: Prodcom database; WifOR analysis.

Among the three biotechnology sectors, agricultural biotechnology has the lowest employment spillover effects, as this sector relies least on labour-intensive inputs. Within its value chain, most of the workforce (51.8%) is already engaged in actual production, i.e., as a direct effect. In contrast, industrial biotechnology has the highest spillover effects (relative to its direct effect). Its intermediate consumption is so labour-intensive that more than half of the total effect is accounted for by employees of suppliers (61.5%). Healthcare biotechnology falls in between these two extremes.

The following Figure 11 illustrates the employment spillover effects of the biotechnology subsectors in comparison to other industries. It shows, that for every job directly generated by healthcare biotech, 2.7 additional jobs are supported in the total economy, leading to a spillover effect of more than 500,640 jobs. Industrial biotechnology is at the top of the biotechnology sectors with an employment multiplier of 3.4. The sector is thus responsible for additional 167,560 jobs in the EU.

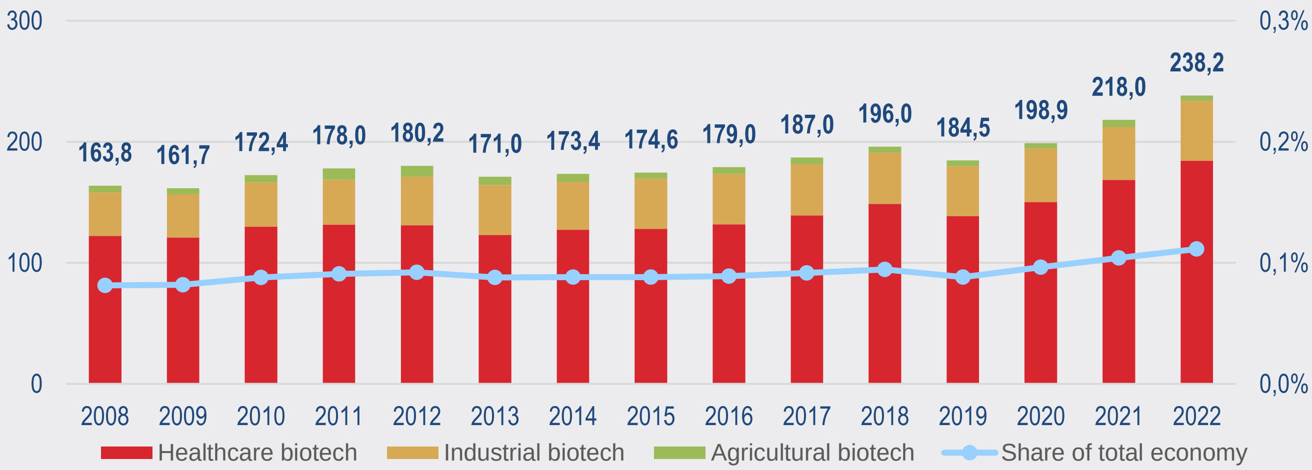
Figure 11: Comparison of employment spillover multipliers



Employment spillover multipliers for the biotechnology sectors and comparable industries
Source: Eurostat: Prodcom database; WifOR own table; WifOR analysis.

Between 2008 and 2018, around 32,000 additional jobs were created. In 2019, however, the biotechnology sector saw a significant decline of 11,500 jobs compared to the previous year. Since then, the sector has grown substantially and has been able to create 53,700 additional jobs, surpassing the total number of jobs created during the entire previous decade (Figure 12).

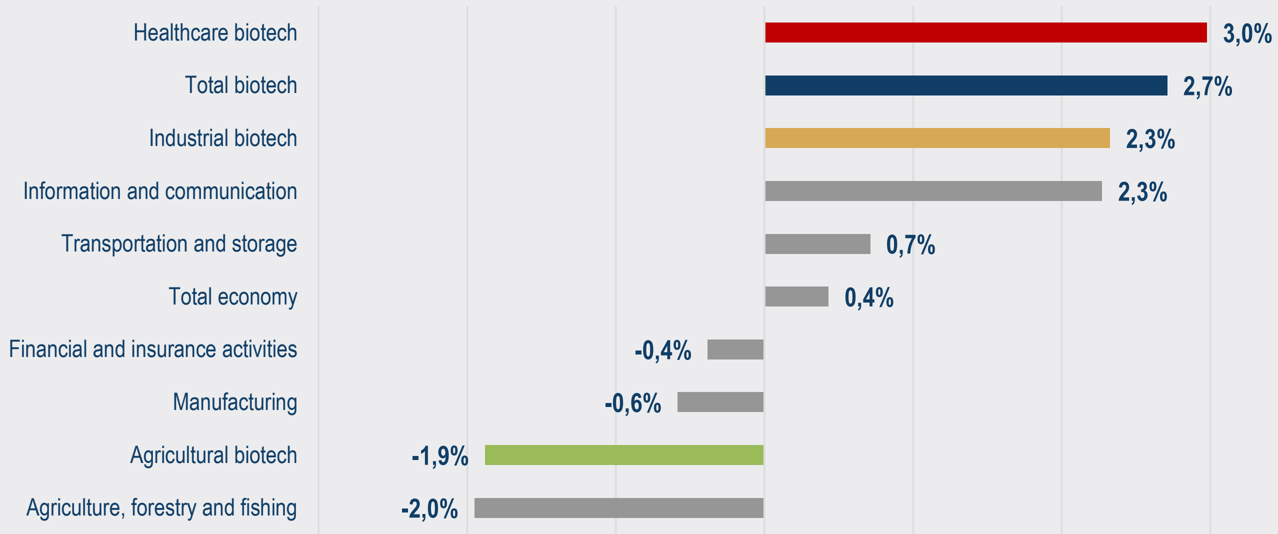
Figure 12: Direct employment effects by biotech sector



Employment time series for the EU biotechnology industry (in thousands, headcount).
Source: Eurostat: Prodcom database; WifOR analysis.

As a result, the biotechnology sector accounted for 0.11% of the total European labour market in 2022, a significant shift from 0.08% in 2008. The rapid increase in employment from 2019 onwards shows a new dynamic for skilled workers in the biotechnology sector. This is a highly significant trend, reflecting the success of biotechnology within the commercial ecosystem and also an indicator of the need for rapid increase in education and skills development to help the EU to continue delivering economic growth. Whilst skills profiles associated with healthcare biotechnology employment are likely to remain high, as industrial biotechnology becomes established as a production process, the associated skills profile is likely to expand and include a broader skills base. This represents a positive employment evolution, as manufacturing demands will align with a wider segment of the European workforce.

Figure 13: Employment compound average growth rate



Employment compound average growth rate, 2008-2022.
Source: Eurostat: Prodcom database, NAMA64e; WifOR analysis.

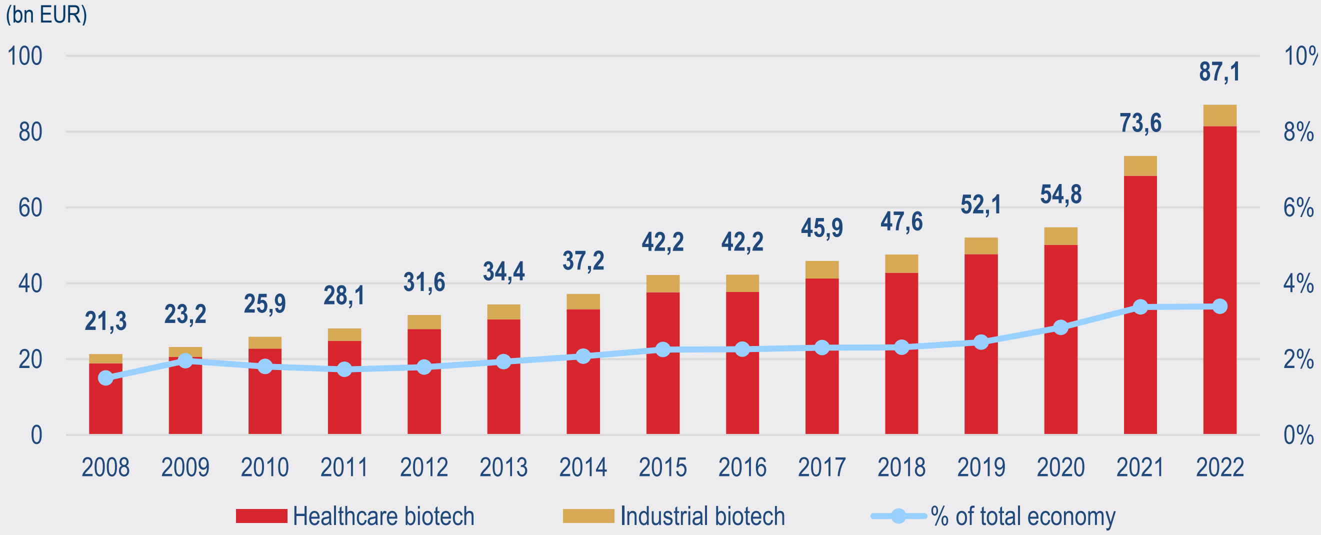
When compared to the overall economic employment growth rate (0.4%) as in Figure 13, the biotechnology industry is a positive stimulus for the European labour market (2.7% annual growth). The absolute employment figures for biotechnology outperform the total economy employment growth with a clear acceleration from 2019 onwards and during the pandemic, most probably due to the new technologies introduced in both healthcare and industrial biotechnology like advanced therapies, mRNA and new industrial processes.

2.4 Trade

In 2022, biotechnology industry exports from the EU amounted to €87.1 bn (Figure 14). This value has almost quadrupled since the financial crisis of 2009, highlighting the remarkable performance for an industry that is still relatively young.

This report only counts exports to non-EU Member States, so trade inside the EU is disregarded (so-called extra-EU trade). Whilst the biotechnology industry's share of overall gross value added is only 0.27%, biotechnological exports account for 3.4% of all exports from the EU to the rest of the world and demonstrate the tremendous potential of biotechnology exports. In addition, between 2008 and 2022, biotechnology exports (10.6%) grew more than twice as fast as total EU exports (4.3%). The Covid pandemic substantially contributed to export value in healthcare biotechnology, reflecting the significant EU manufacturing capacity involved in vaccine production and the strong global nature of healthcare supply chains

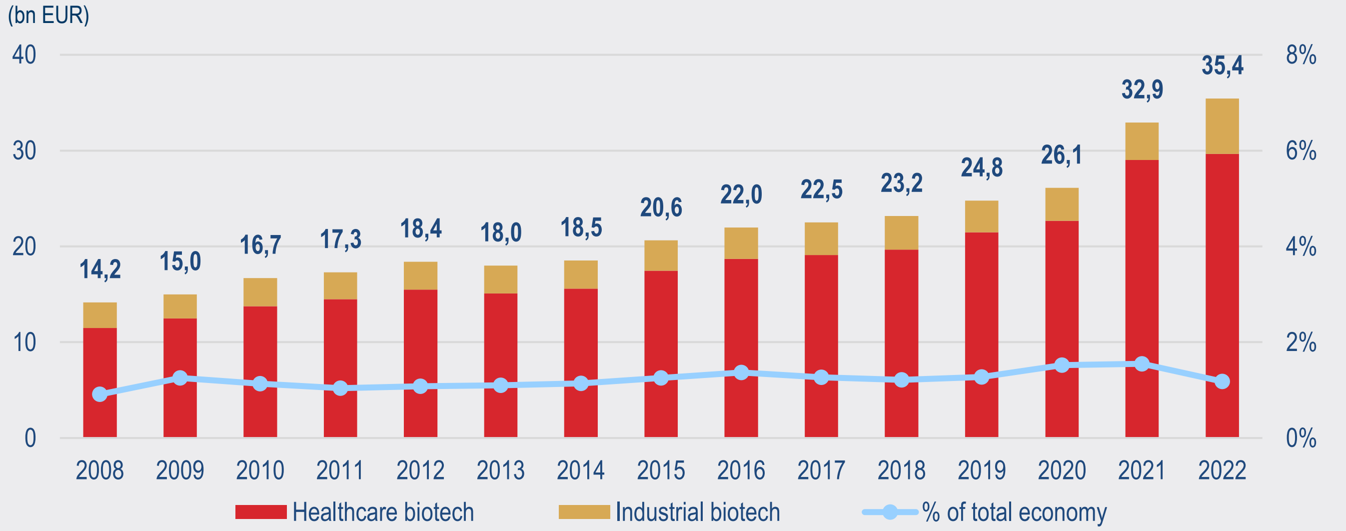
Figure 14: Value of biotechnology exports (extra-EU)



Extra-EU exports of the biotechnology industry.
Source: Eurostat: Prodcom database; WifOR analysis.

Biotechnology imports from outside the EU (extra-EU imports) nearly doubled over the period considered in this study, increasing from €14.2 bn to €35.4 bn (Figure 15). Despite the high level of international integration in biotechnology value chains, this remains only half the level of exports previously mentioned (Figure 14).

Figure 15: Value of biotechnology imports (extra-EU)



Extra-EU imports of the biotechnology industry.
Source: Eurostat: Prodcom database; WifOR analysis.

As a result, biotechnology exports and imports generated a significant trade surplus of €51.7 bn in 2022, as shown in Figure 16. For the EU biotechnology industry across sectors, export value is almost double that of import value. This is relevant not only due to the resulting payment flows into the exporting EU member states but also because it is associated with a lower dependence on countries outside the EU.

Figure 16: Biotechnology trade balance (extra-EU)

Extra-EU trade balance of the EU biotechnology industry.
Source: Eurostat: Prodcom database; WifOR analysis.

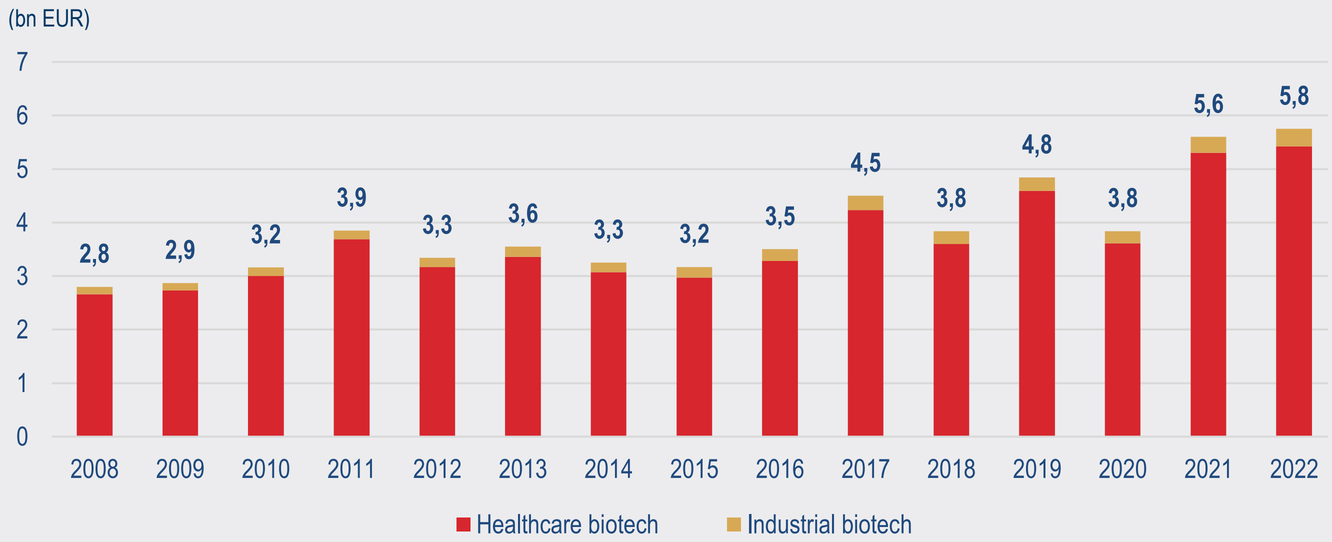
The report demonstrates that the integration of biotechnology into international supply chains has created a significant trade surplus for the EU. As global industrial processes evolve away from fossil-derived inputs and outputs, the EU can increase this further through the right incentives.

2.5 Impact of research and development

The direct contribution to GDP from the biotechnology industry through its internal research activities amounted to approximately €5.75 bn in 2022 (Figure 17). This represents an absolute increase of approximately €2.95 bn since 2008 and corresponds to an average annual growth rate of 5.3%. Intramural research in the context of this study refers to scientific research that is conducted within a company producing healthcare or industrial biotechnological goods, by its own employees, using its own resources and facilities. GVA effects from entities primarily focused on research, such as universities, independent research institutions, or companies that do not produce biotechnological goods, are outside the scope of this study notwithstanding their significant contribution to the EU's innovation capacity.

The intramural research activity is thus growing faster than the biotechnology industry itself (4.7%). In 2022, the healthcare biotechnology industry contributed €5.42 bn and industrial biotechnology €0.33 bn gross value added by engaging in research activities. These data are indicative of the high value of research and development within the EU and its significance in supporting economic outputs

Figure 17: Direct GVA effect of intramural biotechnology R&D activities



Direct GVA impact of the EU biotechnology industry's R&D activities (EU, current prices).
Source: Eurostat: Prodcom database, BERD, teina075_r2, WifOR analysis.

3 The EU biotechnology sector: continuing economic strength

This updated WifOR report extended the data analysis to include 2021 and 2022 and demonstrated the continuing economic growth seen from 2008-2018 in the first report. On all economic factors considered, biotechnology performs significantly above EU industrial average, confirming its position as a highly innovative sector.

Gross Value Added reached €38.1 bn in 2022, with healthcare biotechnology the dominant sector however the fastest rate of growth now from Industrial Biotechnology. This reflects the increasing maturity of biotechnology within healthcare, with EU development over decades, well-established clusters and a high incidence of collaborative research innovation through the value chain, from innovative SMEs to globally active large companies. The industrial biotechnology GVA contribution is likely to continue accelerating as it becomes integrated across more sectors and to a greater extent and should be used as an indicator of EU industry evolution and modernisation, especially compared to other global regions. Products from industrial biotechnology applied across sectors generally have a lower cost than highly innovative breakthrough therapies, however the market is substantially broader, serving manufacturing processes in multiple sectors.

Export strength and trade balance is strongly indicated for the EU through biotechnology, with healthcare remaining the primary driver. From the 2008 starting date of this report, healthcare biotechnology has delivered a significant trade surplus for the EU. This reflects the many decades of investment into national and EU R&D and long term development of manufacturing capacity. The global strength of EU biopharmaceutical manufacturing was demonstrated during the COVID-19 pandemic and, within EU future strategies, the ability to secure manufacturing as an export strength should be integral to incentives, not only for economic growth but also for strength of leverage within global supply chains and access to medicines for EU patients. Industrial biotechnology plays a comparatively lower role in global trade numbers at present, however as it becomes more deeply integrated into sectors that have a strong export profile, such as agri-food, this number is likely to increase. This is reinforced through the higher rate of growth within GVA for industrial biotechnology. For this maturing manufacturing sector, the EU must consider incentivisation strategies that not only enable EU manufacturing for local markets, but also long term investment into manufacturing for export markets.

The labour productivity and employment demonstrated in the report supports the EU drive for a knowledge-driven economy and for high quality employment across regions. As the EU industrial landscape evolves, established industries must act to remain competitive compared to other regions and new industries must emerge and establish supply chain positioning. Within healthcare biotechnology, skills profiles remain high, reflecting the advanced nature of the applications and delivery pathways. Within industrial biotechnology employment, the skills profile has greater diversity, reflecting the nature of the diverse products produced and differing regulatory requirement in terms of manufacturing and product pathway for sectors. For EU regional development, both applications hold value, with industrial biotechnology offering a potentially broader range of commercial opportunities in more regions, reflecting sectors as diverse as food production and large scale manufacturing. The scale of job growth connected to biotechnology remains substantially above the EU average and this is expected to continue, as biotechnology becomes more deeply integrated into industrial process and increasingly reflects innovative product pipelines.

The economic footprint of agricultural biotechnology remains low, with legislative restrictions substantially dis-incentivising investment. However, with NGT legislation and the increasing recognition of the need for a diverse toolbox of technologies to address climate change and food supply, it might be anticipated that the economic footprint expands in future editions of this report.

In summary, biotechnology continues to demonstrate its strategic and economic significance for the European Union. Within a period of intensive global reorganisation, characterised by repeated supply chain shocks, sectors underpinned by advanced innovation will emerge as competitive and resilient in the longer term. This provides the necessary economic foundation for the EU and is manifested through skilled and re-skilled employment across regions and commercial value chains that start and mature within the EU with markets both here and globally.

Methodology

General approach

The fundamental approach to measuring the direct economic contribution of the biotechnology industry in the EU within this study follows a production-based perspective. All goods manufactured in the European Union that fall under our definition—i.e., those identified as biotechnology goods—are taken into account.

As highly detailed data on industrial production is available (via Eurostat's ProdCom database), biotechnology goods can be distinguished as accurately as possible from the rest of manufacturing output. This is particularly relevant because official statistics do not recognise biotechnology as a separate industry. However, segments of different sectors can be aggregated into a cross-sectoral industry based on ProdCom.

Industry definition

The definition of the biotechnology sector used in this study is based on a selection of 106 goods from the ProdCom database. These goods are produced in three different industries, namely Manufacture of food products: beverages and tobacco products (NACE C10-C12), Manufacture of chemicals and chemical products (NACE C20) and Manufacture of basic pharmaceutical products and pharmaceutical preparations (NACE C21). This selection also incorporates preliminary work by the KET Observatory[12], nova-Institute and IDEA consult and has not been changed since the initial study in 2020. As it is not constructive to include very traditional biotechnology users from the craft sector such as bakeries, breweries or wineries as (modern) biotechnology industry, these were excluded.

It is not the source material, but the biotechnological conversion with the help of living organisms or parts of them, such as microorganisms, cells or enzymes, that is decisive for whether the economic value of a good is taken into account in this study. This focus is especially important to differentiate against the physical and chemical conversion of biological raw material what is mainly in the centre of the bioeconomy. The economic importance of this sector was analysed by nova-Institute. In their latest study on the bioeconomy of the EU, they assessed its turnover in 2017 at €2.4 trillion.[13]

[12] IDEA Consult et al., 'Key Enabling Technologies (KETs) Observatory. Second Report'.
[13] BIC and nova-Institute, 'European Bioeconomy in Figures 2008–2017'.

The data calculated in this report can be interpreted as a small subset of this broad and extensive industry definition and reflects the part and importance of biotechnological processing of biomass. The product list at the end of the chapter shows the industry definition for biotechnology used in this report.

CPA-based imputation for anonymised ProdCom data

One limitation of the ProdCom data is that it is often incomplete at the country level. As a result, the reported gross output of a given good in the EU aggregate is higher than the sum of national gross output values. This discrepancy arises because, for confidentiality reasons, certain country-level data points are often suppressed.

Since all subsequent calculations rely on country-level data, we cannot proceed solely with the EU total. Instead, we must allocate the difference across those countries for which no gross output is reported for a given product in a given year.

To distribute this difference, we require a proxy that best represents the relative production potential of the affected countries for the respective good. The supply tables from the FIGARO project serve as a useful reference. At an aggregated level, they provide insights into how EU member states differ in terms of the value of goods produced according to the CPA classification. Given the close conceptual alignment between the ProdCom and CPA classifications, it is possible to map ProdCom goods to their corresponding CPA categories.

The relative share of gross output for the suppressed national data points within the relevant CPA categories then serves as the distribution key for the missing values in the ProdCom data. In the adjusted dataset, the sum of national gross output for the selected biotechnology goods now matches the EU aggregate, preventing an underestimation of the sector's total gross output.

Biotechnology weighting adjustment

Many of the goods included in the applied industry definition are not produced exclusively using biotechnological methods but are still, at least in part, manufactured through traditional processes. Additionally, some of the listed goods represent aggregate categories that include both biotechnologically and traditionally produced items. Furthermore, biotechnology as a production method has become increasingly prevalent over the years covered in this study.

To account for these factors, an expert-based estimation was used to develop a weighting matrix that approximates the biotechnologically relevant share of each listed product for each year. By multiplying the adjusted ProdCom data with these weighting factors, the biotechnological gross output is obtained, serving as the starting point for all further calculations.

Biotechnological agriculture

As agriculture is not part of the production statistics, a different approach had to be taken to determine the biotech-relevant gross output. Genetically modified insect-resistant maize (GM IR maize) is the only biotechnological event approved for cultivation in the EU[14] and the only genetically modified crop with a significant cultivated area.

Additionally, Spain and Portugal are the only EU countries that have grown GM IR maize annually since 2016. Previously, Poland, Slovakia, the Czech Republic, France, and Germany were also involved, albeit with very small amounts. Thankfully, a database on GM crops and their cultivated areas is now available, which has significantly simplified the calculations compared to the initial study.[15]

Thus, in order to determine the relevant gross output for the agricultural biotechnology sector, the share of biotechnological maize acreage in the corresponding national total maize acreage is multiplied by the total value of grain maize production and the average yield markup derived from Brooks[16] to take into account the improved efficiency of GM IR maize.

ProdCom

For this study mostly official statistics have been used. Most notable and essential for this study are the Statistics on production of manufactured goods (ProdCom)[17], the EU production statistics for mining, quarrying and manufacturing. These statistics allow access to gross output, export and import values of about 3,900 industrially manufactured goods (representing section B to C of NACE Rev. 2) for all EU Member States in an annual survey since the early 1990s. This allows a detailed sectoral definition of the biotechnology industry. NACE is the French abbreviation[18] for the Statistical Classification of Economic Activities in the European Community which is used by statistical authorities to distinguish between different industries.

[14] International Service for the Acquisition of Agri-biotech Applications (ISAAA), ‘Global Status of Commercialized Biotech/GM Crops in 2017: Biotech Crop Adoption Surges as Economic Benefits’.
[15] AgbioInvestor GM Monitor - GM and Approval Data, https://gm.agbioinvestor.com/downloads/1
[16] Brookes, ‘Twenty-One Years of Using Insect Resistant (GM) Maize in Spain and Portugal’.
[17] Williams, ‘Europrom PRODCOM Data’.
[18] "nomenclature statistique des activités économiques dans la Communauté européenne"

Gross value added and employment

For the calculation of direct, indirect and induced gross value added and employment effects, multiregional Input-Output tables were used (WifOR Own Table 1.0). Based on our industry definition, the sector-specific production values for the three biotechnology sub-sectors for each year between 2008 and 2022 and for each EU Member State, provided by ProdCom, have been combined with the information provided by Own Table 1.0 to measure direct GVA and employment.

Trade

For each combination of country, year and commodity, ProdCom records not only gross output but also imports and exports. Accordingly, the biotechnology industry definition synonymous with a specific selection of goods and the corresponding weighting factors can yield consistent values for (extra-EU) exports and imports.

Spillover effects

Input-Output analysis was originally developed by Leontief[19] to describe the industrial structure of an economy. Applying this technique, it is possible to trace the inputs of production along the entire supply chain. While in the traditional model households belong to the final demand sector (are exogenous), their activities are included in the model and thus treated as endogenous by using the "fictitious industrial sector approach".

The basis for the calculation of the effects is formed by the following equilibrium equation:

$$\boldsymbol{x} = \boldsymbol{A}\boldsymbol{x} + \boldsymbol{y} \leftrightarrow \boldsymbol{x} = (\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{y}$$

where **x** is the vector of total gross output and **y** is the vector of final demand. $\boldsymbol{A}$ is either the matrix of intermediate consumption coefficients used to calculate the indirect effects or the matrix of intermediate consumption extended by labour income and corresponding consumption coefficients to calculate spillover effects. The equation relates changes in gross output **x** to changes in demand **d**.

Equipped with the output triggered by a given demand (and labour compensation), the corresponding resulting gross value added is derived using country and sector

[19] Leontief, 'Quantitative Input and Output Relations in the Economic Systems of the United States'.

specific ratios of GVA to output. Employment and labour compensation are calculated analogously.[20]

To calculate the indirect and induced effects, multiregional and sector-specific demand vectors have been created for the biotechnology industry of all EU countries under consideration. In order to calculate the induced effects, the resulting demand vector was supplemented by the net disposable income available to employees for consumption purposes. This vector was used as triggering demand to calculate the indirect and induced effects using our global multiregional Input-Output table.

Endogenisation of household consumption in input-output modelling

To calculate the induced economic effects resulting from the activities of the studied subject, household consumption demand is endogenised within the open static input-output model. This approach allows it to be treated as a distinct economic sector, enabling the application of the Leontief inverse for calculations.

As a result, the value-added and employment effects generated at each stage of the supply chain due to household consumption can be quantified. Induced effects, arising from the re-spending of wages and salaries, are modelled as a feedback loop between the additional income generated by increased demand and subsequent consumption.

Data sources

AgbioInvestor: AgbioInvestor GM Monitor - GM and Approval Data, https://gm.agbioinvestor.com/downloads/1, last updated: 30.11.2024

Eurostat: BERD by NACE Rev. 2 activity, https://data.europa.eu/data/datasets/reg0lmh68qwib8rxvgl8sw?locale=en, last updated: 30.11.2024

Eurostat: Gross value added and income by detailed industry (NACE Rev.2), last updated: 30.11.2024, https://data.europa.eu/data/datasets/cl1mabtdvnusipbvxjwv7a

Eurostat: Employment by detailed industry (NACE Rev.2) - national accounts, last updated: 30.11.2024, https://data.europa.eu/data/datasets/wchm1ebqdo3qretkalkw

[20] A detailed description of the Leontief model and the computation of spillover effects may be found in Miller and Blair, 'Input-Output Analysis: Foundations and Extensions'.

Eurostat: PRODCOM database. https://ec.europa.eu/eurostat/de/web/prodcom/overview

Eurostat: teina075_r2: Compensation of employees - NACE Rev. 2, https://data.europa.eu/data/datasets/e4jgj5txvt7laosrs9q0a, last updated: 30.11.2024

EU Science Hub: FIGARO (Full International and Global Accounts for Research in Input-Output Analysis) tables, https://joint-research-centre.ec.europa.eu/scientific-activities/trade-and-industrial-policy-analysis/input-output-accounts/figaro-tables_en, last updated: 30.11.2024

Product list

Figure 18: Initial product list of biotechnological goods

CODE	DESCRIPTION	SECTOR
10621390	Other sugars (including invert sugar) n.e.c.	Industrial
10891334	Bakers yeast	Industrial
10891339	Active yeast (excluding bakers yeast)	Industrial
10891350	Inactive yeasts and other dead single-cell micro-organisms	Industrial
10911010	Premixtures for farm animal feeds	Industrial
10911033	Preparations used for farm animal feeding (excluding premixtures): pigs	Industrial
10911035	Preparations used for farm animal feeding (excluding premixtures): cattle	Industrial
10911037	Preparations used for farm animal feeding (excluding premixtures): poultry	Industrial
10911039	Preparations used for farm animal feeding (excluding premixtures): n.e.c.	Industrial
20111150	Hydrogen	Industrial
20122270	Colouring matter of vegetable or animal origin and preparations based thereon (including dyeing extracts) (excluding animal black)	Industrial
20122350	Inorganic tanning substances; tanning preparations; enzymatic preparations for pre-tanning	Industrial
20141130	Unsaturated acyclic hydrocarbons; ethylene	Industrial
20141140	Propene (propylene)	Industrial
20141150	Butene (butylene) and isomers thereof	Industrial
20141160	Buta-1,3-diene and isoprene	Industrial
20141190	Unsaturated acyclic hydrocarbons: Farnesene, Squalene, Terpenes, NOT C10+ olefins, Acetylene, Linear Alpha Olefins (LAO)	Industrial
20141215	Cyclanes; cyclenes and cycloterpenes (excluding cyclohexane): Limonene	Industrial
20141223	Benzene	Industrial
20141225	Toluene	Industrial
20141250	Styrene	Industrial
20142220	Propan-1-ol (propyl alcohol) and propan-2-ol (isopropyl alcohol)	Industrial
20142230	Butan-1-ol (n-butyl alcohol)	Industrial
20142240	Butanols (excluding butan-1-ol (n-butyl alcohol))	Industrial
20142310	Ethylene glycol (ethanediol)	Industrial
20142333	D-glucitol (sorbitol)	Industrial
20142338	Butane-1,4-diol or tetramethylene glycol (1,4-butanediol) having a bio-based carbon content of 100 % by mass	Industrial
20142360	Glycerol (including synthetic; excluding crude, waters and lyes)	Industrial
20143250	Formic acid, its salts and esters	Industrial
20143271	Acetic acid	Industrial
20143310	Acrylic acid and its salts and other monocarboxylic acid	Industrial

CODE	DESCRIPTION	SECTOR
20143367	Phenylacetic acid; its salts and esters	Industrial
20143381	Oxalic, azelaic, malonic, other, cyclanic, cylenic or cycloterpenic polycarboxylic acids, salts (excluding butanedioic acid having a bio-based carbon content of 100 % by mass): itaconic, malonic	Industrial
20143382	Ethane-1,2-dicarboxylic acid or butanedioic acid (succinic acid) having a bio-based carbon content of 100 % by mass	Industrial
20143383	Oxalic, azelaic, maleic, other, cyclanic, cylenic acids, salts	Industrial
20143385	Adipic acid; its salts and esters	Industrial
20143387	Maleic anhydride	Industrial
20143473	Citric acid and its salts and esters	Industrial
20143475	Carboxylic acid with alcohol, phenol, aldehyde or ketone functions: Ethyl lactate, Hydroxypropionic acid (3-), Lactic acid, Lactide, Levulinic acid, Ricinoleic acid (aka 12-Hydroxyoctadec-9-enoic acid)	Industrial
20144123	Hexamethylenediamine and its salts; ethylenediamine and its salts	Industrial
20144350	Acrylonitrile	Industrial
20145139	Other organo-sulphur compounds	Industrial
20146113	Ethanal (acetaldehyde)	Industrial
20146115	Butanal (butyraldehyde; normal isomer)	Industrial
20146211	Acetone	Industrial
20146213	Butanone (methyl ethyl ketone)	Industrial
20146450	Rennet and concentrates thereof	Industrial
20146470	Enzymes; prepared enzymes (not elsewhere specified or included) (excluding rennet and concentrates)	Industrial
20147320	Benzol (benzene), toluol (toluene) and xylol (xylenes)	Industrial
20147400	Undenatured ethyl alcohol of an alcoholic strength by volume >= 80 % (important: excluding alcohol duty)	Industrial
20147500	Denatured ethyl alcohol and other denatured spirits; of any strength	Industrial
20161035	Linear polyethylene having a specific gravity <†0,94, in primary forms	Industrial
20161039	Polyethylene having a specific gravity <†0,94, in primary forms (excluding linear)	Industrial
20161050	Polyethylene having a specific gravity of >=†0,94, in primary forms	Industrial
20162070	Acrylonitrile-butadiene-styrene (ABS) copolymers, in primary forms	Industrial
20164015	Polyethylene glycols and other polyether alcohols, in primary forms	Industrial
20164030	Epoxide resins, in primary forms	Industrial
20164050	Alkyd resins, in primary forms	Industrial
20164080	Unsaturated polyesters, in primary forms (excluding liquid polyesters, polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate)	Industrial
20164090	Polyesters, in primary forms (excluding polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate, other unsaturated polyesters)	Industrial
20165130	Polypropylene, in primary forms	Industrial
20165350	Polymethyl methacrylate, in primary forms	Industrial
20165450	Polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	Industrial
20165490	Polyamides, in primary forms (excluding polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12)	Industrial
20165670	Polyurethanes, in primary forms	Industrial
20165920	Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms	Industrial
20165940	Cellulose and its chemical derivatives, n.e.c., in primary forms	Industrial
20165960	Natural and modified natural polymers, in primary forms (including alginic acid, hardened proteins, chemical derivatives of natural rubber)	Industrial
20165970	Ion-exchangers based on synthetic or natural polymers, in primary forms	Industrial
20201190	Other insecticides	Industrial
20201370	Plant-growth regulators put up in forms or packings for retail sale or as preparations or articles	Industrial
20201590	Other fungicides, bactericides and seeds treatments (ex: Captan,...)	Industrial
20411000	Glycerol (glycerine), crude; glycerol waters and glycerol lyes	Industrial
20412050	Non-ionic organic surface-active agents (excluding soap): Alkyl polypentosides (C5-surfactants), Alkyl polyglucosides (APG)	Industrial

CODE	DESCRIPTION	SECTOR
20412090	Organic surface-active agents (excluding soap, anionic, cationic, non-ionic): among others Sophorolipids	Industrial
20595210	Composite diagnostic or laboratory reagents, including paper impregnated or coated with diagnostic or laboratory reagents	Healthcare
20595640	Compound plasticisers for rubber or plastics	Industrial
20595770	Sorbitol (excluding D-glucitol)	Industrial
20595957	Mixtures of mono-, di- and tri-, fatty acid esters of glycerol (emulsifiers for fats)	Industrial
20595997	Biofuels (diesel substitute)	Industrial
21102010	Lysine and its esters, and salts thereof	Healthcare
21102020	Glutamic acid and its salts	Healthcare
21103119	Lactones (excl. phenolphthalein; 1-Hydroxy-4-[1-(4-hydroxy-3-methoxycarbonyl-1-naphthyl)-3-oxo-1H,3H-benzo[de]isochromen-1-yl]-6-octadecyloxy-2-naphthoic acid; 3'-Chloro-6'-cyclohexylaminospiro[isobe	Healthcare
21105100	Provitamins and vitamins, natural or reproduced by synthesis (including natural concentrates), derivatives thereof used primarily as vitamins, and intermixtures of the foregoing, whether or not in any solvent	Healthcare
21105200	Hormones, prostaglandins, thromboxanes and leukotrienes, natural or reproduced by synthesis; derivatives and structural analogues thereof, including chain modified polypeptides, used primarily as hormones	Healthcare
21105300	Glycosides and vegetable alkaloids, natural or reproduced by synthesis, and their salts, ethers, esters and other derivatives	Healthcare
21105400	Antibiotics	Healthcare
21106055	Human blood; animal blood prepared for therapeutic, prophylactic or diagnostic uses; cultures of micro-organisms; toxins (excluding yeasts)	Healthcare
21201130	Medicaments containing penicillins or derivatives thereof, with a penicillanic acid structure, or streptomycins or their derivatives, for therapeutic or prophylactic uses, n.p.r.s.	Healthcare
21201150	Medicaments of other antibiotics, n.p.r.s.	Healthcare
21201160	Medicaments of penicillins, streptomycins or derivatives thereof, in doses or p.r.s.	Healthcare
21201180	Medicaments of other antibiotics, p.r.s.	Healthcare
21201230	Medicaments containing insulin but not antibiotics, for therapeutic or prophylactic uses, not put up in measured doses or for retail sale	Healthcare
21201250	Medicaments containing hormones but not antibiotics, for therapeutic or prophylactic uses, not put up in measured doses or for retail sale (excluding insulin)	Healthcare
21201260	Medicaments containing insulin but not antibiotics, for therapeutic or prophylactic uses, put up in measured doses or for retail sale	Healthcare
21201270	Medicaments containing corticosteroid hormones, their derivatives and structural analogues, put up in measured doses or for retail sale	Healthcare
21201310	Medicaments of alkaloids or derivatives thereof, n.p.r.s.	Healthcare
21201320	Other medicaments for therapeutic or prophylactic uses, of HS 3003, n.p.r.s.	Healthcare
21201340	Medicaments of alkaloids or derivatives thereof, p.r.s.	Healthcare
21201360	Medicaments containing vitamins, provitamins, derivatives and intermixtures thereof, for therapeutic or prophylactic uses, put up in measured doses or for retail sale	Healthcare
21201380	Other medicaments of mixed or unmixed products, p.r.s., n.e.c.	Healthcare
21202145	Vaccines for human medicine	Healthcare
21202160	Vaccines for veterinary medicine	Healthcare
21202200	Chemical contraceptive preparations based on hormones or spermicides	Healthcare
21202320	Blood-grouping reagents	Healthcare
109010Z0	Preparations for animal feeds (excluding dog or cat food, p.r.s.)	Industrial

Over time, the ProdCom database tries to add new products, which leads to the split or removal of old product codes. Since the initial study in 2020, the following codes were added to preserve the initial industry definition:

Figure 19: Added product codes since 2020

CODE	DESCRIPTION	SECTOR
20595800	Biodiesel and mixtures thereof, not containing or containing < 70 % by weight of petroleum oils or oils obtained from bituminous minerals	Industrial
21202126	Antisera, other blood fractions and immunological products, whether or not modified or obtained by means of biotechnological processes	Healthcare
20201110	Insecticides (excluding carbofuran (ISO) and trichlorfon (ISO))	Industrial
20201591	Other fungicides, bactericides and seeds treatments (ex: Captan,...) (excluding hazardous pesticides, carbofuran (ISO) and trichlorfon (ISO))	Industrial
20595211	Diagnostic or laboratory reagents on a backing, prepared diagnostic or laboratory reagents whether or not on a backing, whether or not put up in the form of kits; ; certified reference materials	Healthcare
21106051	Cell therapy products	Healthcare
21106052	Other cell cultures, whether or not modified	Healthcare
21106053	Human blood; animal blood prepared for therapeutic, prophylactic or diagnostic uses; other products n.e.c. in the HS heading 3002	Healthcare
21201381	Other medicaments of mixed or unmixed products, p.r.s., n.e.c.	Healthcare
21202146	Vaccines against SARS-related coronaviruses "SARS-CoV species", for human medicine	Healthcare
21202149	Vaccines for human medicine (excl. vaccines against SARS-related coronaviruses)	Healthcare

Glossary

Direct effects	The immediate economic effects directly generated by a company or industry.
Employment	The number of jobs created, measured on a headcount basis.
Gross value added	Describes a company's or industry's contribution to the gross domestic product (GDP).
Indirect effects:	The production activities of a company require purchased materials and services. Such purchased materials and services in turn result in increased production among suppliers also requiring purchased materials and services for their own production process. The resulting cascading effects (e.g., employment, gross value added) are referred to as indirect economic effects.
Induced effects:	These originate from the expenditure of directly and indirectly generated incomes. The compensation of employees directly paid by a company or industry and paid by their suppliers to be able to satisfy the demand further increases the demand in the economy. This additional demand triggers economic effects (GVA, employment) which are summed up under the term induced economic effects.
Labour productivity:	Direct GVA per directly employed person.
NACE:	The Statistical Classification of Economic Activities in the European Community (NACE) is the industry standard classification system used in the European Union. National accounts data is recorded according to this system. The basic underlying principle is to assign a specific NACE code to each unit recorded in statistical business registers based on their main principal activity. The principal activity is the activity which contributes most to the value added of the unit. If for example one company generates most of its GVA by manufacturing pharmaceutical goods, it is assigned the NACE two-digit code 21 which corresponds to the pharmaceutical industry. The current version of NACE is revision 2 (NACE Rev. 2) and in general is used for statistics referring to economic activities performed as from 1 January 2008 onwards.
GM IR maize	Genetically modified insect-resistant maize is maize engineered to resist insect pests. In the EU, it is the only GM crop with significant cultivation, mainly grown in Spain and Portugal.
Gross output	Measures the amount produced by the company or industry, based on sales, including changes in stocks and the resale of goods and services. The gross output is defined as turnover, plus or minus the changes in stocks of finished products, work in progress and goods and services purchased for resale, minus the purchases of goods and services for resale, plus capitalised production, plus other operating income (excluding subsidies).
Spillover effects:	The combined effects of indirect and induced economic effects.

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